THE MISSISSIPPI DRUG EPIDEMIC SURVEILLANCE SYSTEM

Epidemiological Report
5/24/2019

Neonatal Hospitalizations Related to Substance Use in Mississippi: Surveillance Report, 2010-2017

MISSISSIPPI STATE DEPARTMENT OF HEALTH

KEY FINDINGS

In Mississippi, neonatal hospital stays related to substance use spiked, from 113 in 2010 to 689 in 2017.
During 2016-2017 in Mississippi:

- Neonatal stays associated with substance use were nearly three times as costly as all other neonatal stays ($32,451 versus $12,555). Medicaid was responsible for 77.0% of the total hospital charges. The hospital charges increased by 16.6%, from $19,936,930 in 2016 to $23,255,948 in 2017.
- Comorbidities were highly prevalent among infant stays related to substance exposure: 26.7% had coexisting respiratory conditions, 26.7% had a coexisting low birth weight, and 13.9% had a coexisting congenital disease.
- Several clusters of high hospitalization rates for infants affected by substance use were identified: the northeastern corner of the state, the Gulf Coast area, and the Pine Belt region.

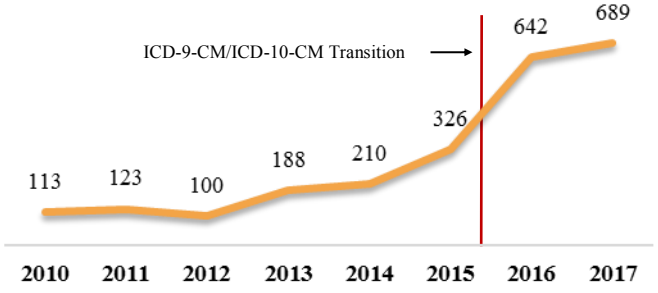
Background: In addition to increasing morbidity and mortality rates among adults, the prescription opioid epidemic also has led to increased risks to infants from *in utero* opioid exposure. Although neonatal abstinence syndrome (NAS) is historically attributed to prenatal opioid abuse or methadone treatment during pregnancy, other prescription or illicit substances may cause symptoms of withdrawal in exposed infants. The growing epidemic of prescription and illicit drug use imposes an urgent need for monitoring the impact of maternal substance use on infants. Hospital discharge data, a population-level data source, present an opportunity for such surveillance.

Data Source: Health care data are one of the richest and most valuable sources of health-related information. In addition to clinical diagnoses and procedures performed, this data source contains information on patient demographics, expected payers, hospital charges, and length of stay. In Mississippi, all hospitals are required to submit data on inpatient stays, emergency department encounters, and outpatient visits to the Inpatient Outpatient Data System, a collaborative effort between the Mississippi Hospital Association and Mississippi State Department of Health. Reporting hospitals are short-term general hospitals, specialty hospitals, and long-term healthcare facilities.

Methods: We performed a retrospective analysis of inpatient hospital stays for state resident and non-resident newborns**.** Presented in the report are the numbers, rates, and evolving trends in infant hospitalization associated with substance use from 2010 through 2017. In addition, we evaluated the demographic and comorbid characteristics, hospital charges, and length of stay for substance-related neonatal (0-28 days) stays during 2016-2017. The unit of analysis is a hospitalization not an individual patient. Included in the report are cases with primary and secondary diagnoses of infant exposure to drugs of abuse, excluding tobacco and alcohol.

All Drug-Related Diagnoses: The number of infant hospitalizations due to substance exposure increased dramatically, from 113 infants in 2010 to 689 infants in 2017 (Figure 1). This spike may be attributed to the 2015 implementation of new diagnostic codes that allowed for the coding of non-specific maternal drug abuse. Following this surge, the trend moderated but continued to increase. Compared to 2016, there were 47 more infants hospitalized in 2017 following maternal use of addictive drugs.

Figure 1. Neonatal Hospitalizations Related to Substance Use in MS, 2010-2017



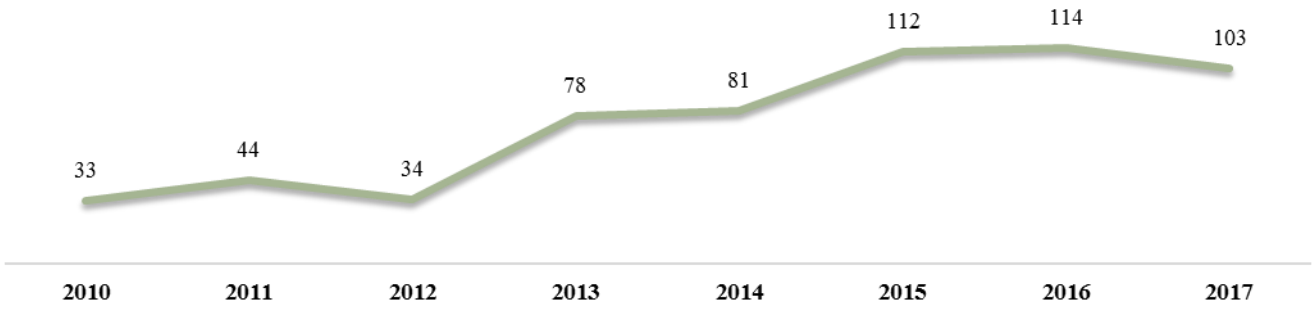
Diagnostic Codes: There is a paucity of diagnostic codes identifying drugs or drug groups that affect infants born to drug dependent mothers. A complicating factor is the change in the classification system used to code clinical diagnoses and medical procedures that occurred during the study period. Between 2010 and the first three quarters of 2015, diagnoses and procedures in health care data were coded using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). The International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) was introduced in the fourth quarter of 2015, replacing the previous classification system, ICD-9-CM.

Since the two classification systems differ in their coding schemes, hospitalization data before and after 2015 are difficult to compare. For example, infants impacted by maternal use of opioids were categorized historically either under the subgroup of neonatal abstinence syndrome or the subgroup of narcotics. The diagnostic code for narcotics, however, was discontinued after the transition from ICD-9-CM to ICD-10-CM. At the same time, a new subgroup of unspecified drug codes was introduced in 2015. Thus, the previous classification system, ICD-9-CM, had codes for three different substances of abuse: narcotics (i.e., opioids), hallucinogens (e.g., LSD), and cocaine. In the current classification system, ICD-10-CM, the diagnostic codes are reduced to only two specific codes, hallucinogens and cocaine, and one unspecified code.

Newborns Exposed to Substances of Abuse: ICD-9-CM and ICD-10-CM Diagnostic Codes				
Neonatal Abstinence Syndrome (NAS)	Narcotics Until 2015	Hallucinogens	Cocaine	Unspecified Since 2015
ICD-9-CM 779.5 ICD-10-CM P96.1	ICD-9-CM 760.72 ICD-10-CM No Code	ICD-9-CM 760.73 ICD-10-CM P04.42	ICD-9-CM 760.75 ICD-10-CM P04.41	ICD-9-CM No code ICD-10CM P04.40 and P04.49

Neonatal Abstinence Syndrome: The neonatal abstinence syndrome is a clinical condition in newborn caused by the prolonged exposure of the fetus to drugs of addiction used during pregnancy. The sudden discontinuation of these drugs after delivery causes an onset of withdrawal signs. According to literature reports, between 55% and 94% of exposed infants develop withdrawal.[1] During 2017, on average, a baby suffering from drug withdrawal was born every three and half days in Mississippi. The overall trend was upward during the study period, except for two dips: between 2011 and 2012 and between 2016 and 2017 (Figure 2).

Figure 2. Hospitalizations for Neonatal Abstinence Syndrome in MS, 2010-2017

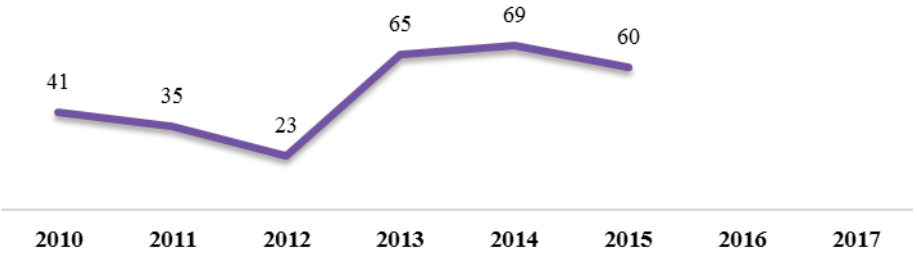


Clinical Signs of Neonatal Abstinence Syndrome: The intrauterine exposure to drugs of addiction could be associated with a constellation of clinical signs of the nervous and gastrointestinal systems such as restlessness, high-pitched crying, irritability, sleep disturbances, tremors, seizures, feeding difficulties, diarrhea, and failure to thrive.[2] Such clinical signs may have various degrees of severity depending on the level of exposure. In addition, neonatal withdrawal may be evident in the first 24-72 hours of life, but signs of the condition may also be delayed by a week or longer. The nonspecific nature of the signs associated with the intrauterine exposure to addictive drugs and short hospitalization stays make the neonatal abstinence syndrome difficult to recognize.

Drugs of Abuse: Presented in figures 3-6 are trends of hospitalizations for infants affected by substance use by drug groups. Hospitalizations for infants affected by maternal cocaine use demonstrated an overall uptrend between 2010 and 2017. Hospitalizations for infants affected by maternal hallucinogen use increased from 2010 until 2015; however, after this year such cases were no longer reported. As previously mentioned, the introduction of new codes for non-specific drug use had a pronounced effect on the number of reported infant cases affected by maternal substance abuse. Such a change in the categorization scheme resulted in a significant increase in the overall number of infant hospitalizations related to maternal drug abuse. This sharp shift in data trends suggests that statistics on substance use and abuse are highly sensitive to changes in the classification scheme used to categorize them.

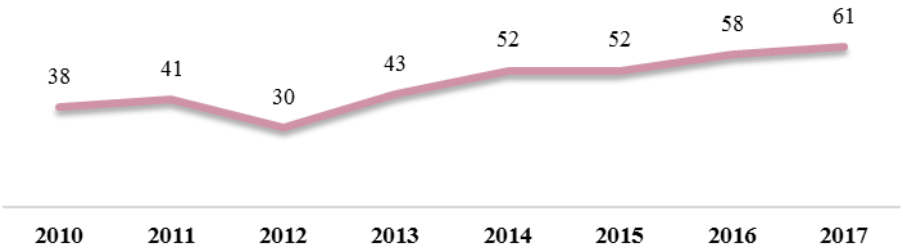
Narcotics: The number of infant hospitalizations related to maternal use of narcotics increased by 46.3% between 2010 and 2015. (Figure 3). This diagnostic code was used to record hospitalizations for opioid-exposed infants. Presently, there is no opioid-specific ICD-10-CM diagnostic code.

Figure 3. Neonatal Hospitalizations Related to Maternal Use of Narcotics (e.g., Opioids) in MS, 2010-2015



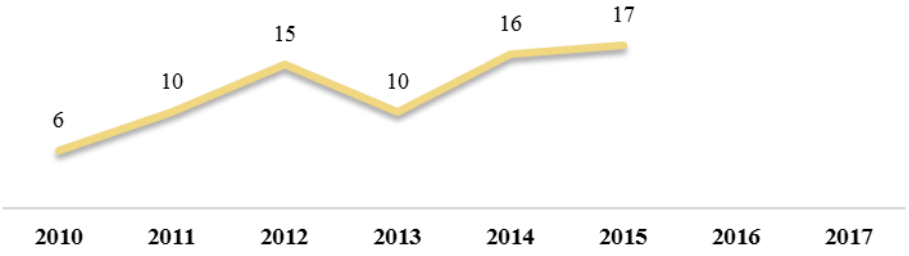
Cocaine: The number of infant hospital discharges related to maternal use of cocaine increased by 60.5% from 2010 to 2017 (Figure 4). According to the American Academy of Pediatrics, the prenatal use of cocaine has a negative impact on fetal growth and long-term effects on behavior.[3]

Figure 4. Neonatal Hospitalizations Related to Materneal Use of Cocaine in MS, 2010-2017



Hallucinogens: The number of infant hospital discharges related to maternal use of hallucinogens almost tripled between 2010 and 2015 (Figure 5). Although ICD-10-CM has a code for hallucinogen-exposed infants, there were no such cases reported during 2016 and 2017. It is not clear if this is a data coding or a reporting issue.

Figure 5. Neonatal Hospitalizations Related to Materneal Use of Hallucinogens in MS, 2010-2017



Unspecified Drugs: The group of codes denoting maternal use of unspecified drugs of addiction was introduced in 2015. Unspecified hospitalizations increased from 2016 to 2017 (Figure 6). Although such coding captures ill-defined cases of maternal drug use, the lack of specificity obstructs precise and detailed case monitoring.

Figure 6. Neonatal Hospitalizations Related to Maternal Use of Unspecified Drugs in MS, 2015-2017

Demographic Characteristics: There were more infant hospitalizations related to substance use among Caucasian infants (733 or 55.1%) compared to African-American infants (570 or 42.8%) and other racial groups (28 or 2.1%). The hospitalization rates, however, were similar for Caucasian and African-American infants, respectively 17.1 and 17.5 substance use-related infant hospitalizations per 1,000 live births. Males (675 or 50.7%) and females (655 or 49.2%) were similarly affected (the sex of one infant was unknown).

Comorbidities: Neonatal stays related to substance use were assessed for five groups of comorbid conditions. Compared to all other neonatal stays, neonatal stays related to substance use were more likely to have respiratory complications (26.7% versus 10.5%), low birth weight (26.7% versus 9.9%), congenital diseases (13.9% versus 8.7%), and feeding difficulties (8.7% versus 3.0%) (Figure 7). Seizures, a hallmark sign of severe neonatal withdrawal, were recorded in only 10 infant hospital stays related to substance use (Table 1).

Figure 7. Comorbidities Associated with Neonatal Hospitalizations Related to Substance Use in MS, 2016-2017

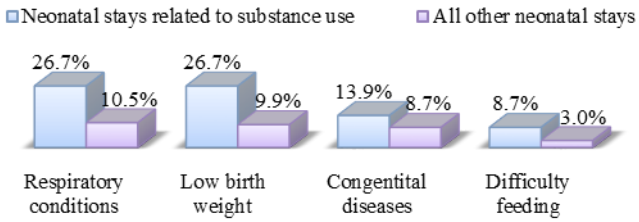


Table 1. Neonatal hospitalizations and associated comorbidities in MS: combined data for 2016-2017

Co-occurring conditions	All neonatal hospitalizations (N = 72,929)		Neonatal hospitalizations related to substance use (N = 1,331)		All other neonatal hospitalizations (N = 71,598)		p-value
	Number	%	Number	%	Number	%	
Respiratory conditions	7,856	10.8	355	26.7	7,501	10.5	<0.001
Low birth weight	7,410	10.2	355	26.7	7,055	9.9	<0.001
Congenital diseases	6,413	8.8	185	13.9	6,228	8.7	<0.001
Difficulty feeding	2,264	3.1	116	8.7	2,148	3.0	<0.001
Seizures (convulsions)	185	0.3	10	0.8	175	0.2	0.002

This analysis was performed using the following ICD-10-CM diagnostic codes: respiratory conditions (P22-28), low birth weight (P05, P070, P071), congenital diseases (Q00-Q99), feeding difficulties of newborn (P92), convulsions of newborn (P90).
We compared comorbidities between neonatal stays with and without substance-related diagnoses with chi-square tests and Fisher's exact tests, as appropriate.

Length of Stay: The mean length of stay for neonatal stays related to substance use was 9.1 days in 2016 and 2017. In comparison, the mean length of stay for all other neonatal hospitalizations was considerably shorter: 3.8 days in 2016 and 3.7 days in 2017. The total days infants exposed to drugs of abuse spent in hospital increased by 7.5%, from 5,811 days in 2016 to 6,245 days in 2017.

Hospital Charges: The total charges increased by 16.6%, from $19,936,930 in 2016 to $23,255,948 in 2017, totaling $43 million for the two-year period (Table 2). During the same time, the mean charges of $32,451 for neonatal stays related to substance use were nearly three times higher than the mean charges of $12,555 for all other neonatal stays. Moreover, there were differences in the health insurance coverage between newborns with and without substance exposure. During 2016-2017, Medicaid was responsible for the vast majority (77.0%) of substance-related neonatal stays versus 58.6% of all other neonatal stays (Figure 8). Compared with all other neonatal stays, infants affected by drugs of abuse were over twice more likely to be uninsured (8.1% versus 3.8%) and nearly four times less likely to have private insurance coverage (8.6% versus 31.2%).

Figure 8. Neonatal Hospitalizations Related to Substance Use by Payer in MS, 2016-2017

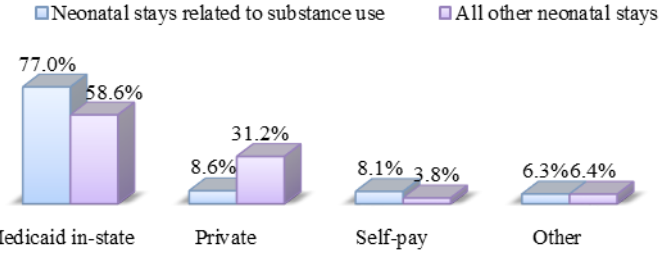


Table 2. Primary expected payer for neonatal hospitalizations related to substance use in MS, 2016 and 2017

Payer	Hospitalizations (%)	Mean charges	Total charges
Medicaid in-state	1,025 (77.0)	$35,465	$36,351,868
Private	114 (8.6)	$33,089	$3,772,154
Self-paid	108 (8.1)	$20,259	$2,187,983
Other	84 (6.3)	$10,487	$880,873
Total	1,331 (100.0)	$32,451	$43,192,878

Geographic Variations, 2016-2017: The vast majority of Mississippi's 82 counties are sparsely populated. As a result of their small population size, many of these counties have reported a correspondingly small number of events. This low number of reported incidents complicates the task of calculating reliable rates, which requires a minimum number of at least 20 cases. To address this challenge, we combined data from 2016 through 2017. After aggregating our data longitudinally, 17 Mississippi counties reported 20 or more cases of infant hospitalizations related to substance use during the study period. Displayed in Table 3, are the number of infant hospitalizations as well as the hospitalization rates for these 17 counties.

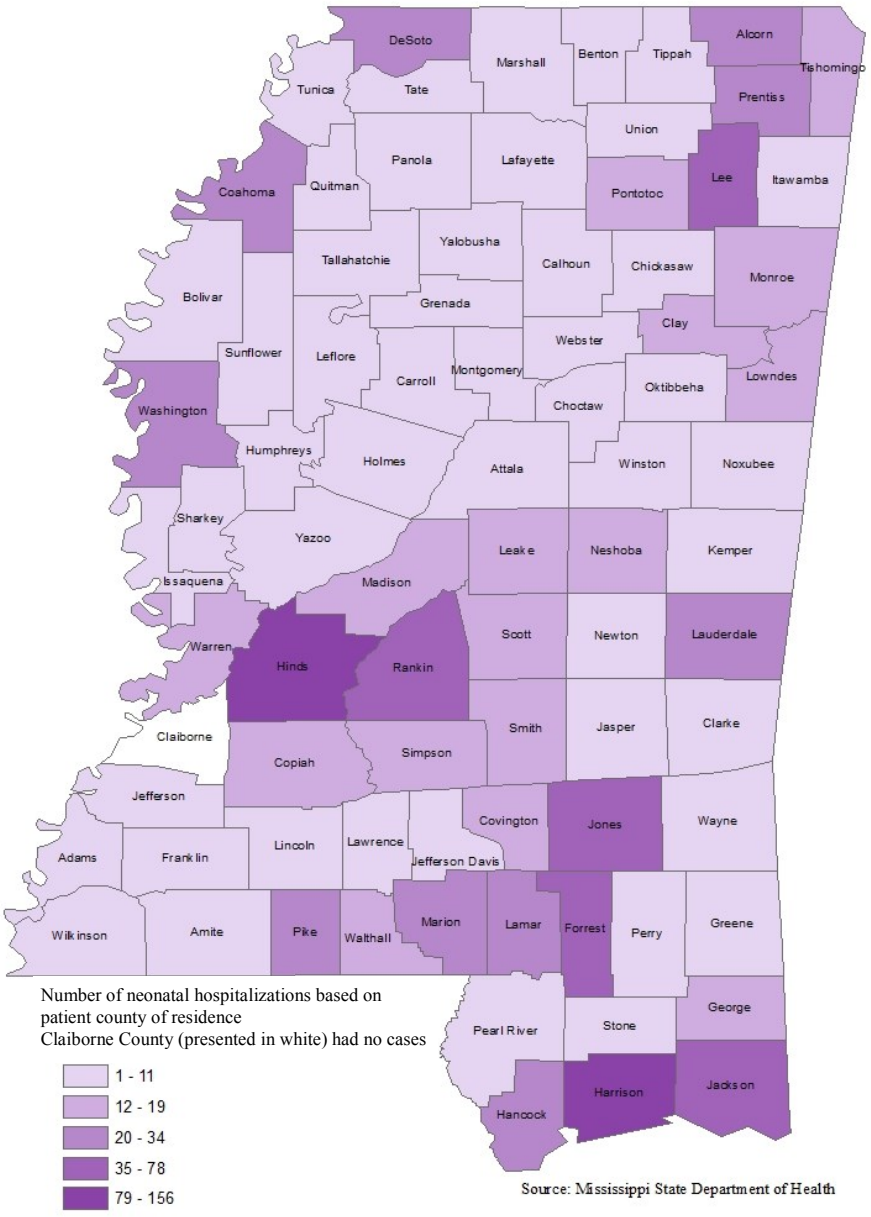
Geographical "Hot Spots" in MS, 2016-2017: To evaluate the geographic distribution, we ranked the counties with more than 20 events by their hospitalization rates (Table 3). Then, we compared the county-specific rates with the statewide rate. During 2016-2017, the statewide average rates was 17.2 substance-related neonatal hospitalizations per 1,000 live births and there were 12 counties with higher hospitalization rates than the state average. These 12 counties are marked with an asterisk in Table 3. Based on this analysis, we identified three clusters of high hospitalization rates: the northeastern corner of the state (Alcorn, Prentiss, and Lee), the southern coastal region (Harrison, Hancock, and Jackson), and the Pine Belt region (Marion, Pike, Forrest, Jones, and Lamar).

Hospitalization Rates in MS, 2016 and 2017: The statewide rate was 16.5 in 2016 and 17.9 infant hospitalizations related to substance use in 2017 per 1,000 live births, representing a 8.5% increase. Rates were calculated only for Mississippi residents (1,294 out of 1,331 hospitalizations) and are based on patient county of residents.

Table 3. Neonatal hospitalizations related to substance use: Number and rates for counties with more than 20 cases in MS, 2016-2017

County	Number of neonatal hospitalizations related to substance use	Rate per 1,000 live births
Alcorn*	34	39.9
Prentiss*	25	39.8
Marion*	22	37.1
Lee*	78	32.8
Coahoma*	23	31.0
Pike*	33	30.0
Harrison*	156	28.5
Hancock*	22	24.1
Forrest*	43	21.5
Jones*	39	21.3
Hinds*	132	21.1
Lamar*	32	19.8
Washington	21	16.2
Lauderdale	29	14.8
Jackson	40	12.1
Rankin	38	10.7
DeSoto	25	5.8

Neonatal Hospitalizations Related to Substance Use in MS, Combined Data for 2016-2017



Source: Mississippi State Department of Health

PUBLIC HEALTH GOALS

The goal of this report is to increase awareness among the medical community, public health structures, and policy makers about the impact of maternal substance use on infant health, a condition associated with severe health outcomes and high societal costs. The specific objectives are outlined below:

- Engaging the maternity hospitals in our state to collaborate on the development and implementation of standardized protocols for the identification, management, and follow-up of infants exposed to drugs of addiction during pregnancy.
- Reaching out to prenatal care providers and underlining the necessity of screening for substance abuse disorders (SUD) during the prenatal period as well as the need for the timely treatment and follow-up of such disorders.
- Building support groups for newborns affected by substance use and their mothers — drug abuse is a disease — mothers and babies affected by substance abuse need family, community, and social support.
- Encouraging measures aimed at expanding treatment options for women with SUD and extending effective therapeutic approaches such as methadone or buprenorphine maintenance therapies.[4]
- Drawing attention to addiction treatment barriers — substance-using pregnant women may fear to seek medical care because of shame, stigma, possible criminal sanctions, or losing custody of children.[5]

Across the nation, 23 states consider substance use during pregnancy to be child abuse under civil child-welfare statutes.[6] Mississippi is not one of those states. According to the American College of Obstetrics and Gynecologists (ACOG), the use of punitive legal approaches to address perinatal substance abuse is counterproductive and inappropriate.[7] Instead of legal actions, ACOG advocates for the implementation of safe, affordable, and comprehensive drug treatment services for pregnant women. Specifically, ACOG recommends early universal screening for substance use disorders, brief intervention (e.g., discussions and medical advice), and referral to specialized treatment.[8] The Mississippi State Department of Health (MSDH) supports the development of such multi-disciplinary statewide approaches aimed at early diagnosis and comprehensive treatment of SUD during pregnancy and motherhood. Substance-dependent pregnant women should be given the needed medical care and social support to be successful mothers.

WHAT WE AT THE MISSISSIPPI STATE DEPARTMENT OF HEALTH DO

The Early Intervention (First Steps) is a federal program at MSDH that provides services to infants and young children with developmental delays and disabilities. This support may include comprehensive development assessment, service coordination, behavioral services, speech therapy, physical therapy, language development and other services. Perinatal substance use may lead to development delays. Infants with disorders secondary to drugs or alcohol exposure qualify for such development support. For more information and to seek help for your child, please visit MSDH's website at: https://msdh.ms.gov/msdhsite/_static/41,0,74.html#services.

Perinatal High Risk Management/Infant Services System (PHRM/ISS) is a case management program established to increase access to health care and social services for Medicaid-eligible pregnant/postpartum women at-risk for health complications (e.g., substance use). Supportive services may include finding doctors for maternity/ child care, offering health education as well as psycho-social and nutritional assessments/counseling, assisting with supplemental nutritional programs (WIC), and providing visits by nurses, social workers, and nutritionists. For more information, please visit MSDH's website at: https://msdh.ms.gov/msdhsite/_static/41,0,106.html.

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